

Exposure Assessment of Fume Released During Sealing of Polyterafluorethylene Fabric

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Background

Apparel workers may be exposed to polytetrafluoroethylene (PTFE) fume when sealing seams of fabrics containing PTFE. During the sealing of seams, adhesive tape is applied over a fabric seam with a 600°C jet of hot air, releasing fume.

Facility Information

- Over 1,000 jackets made each day
- 41 stations to seal seams, each with local exhaust ventilation
- Sewing, sorting and quality control stations share the area



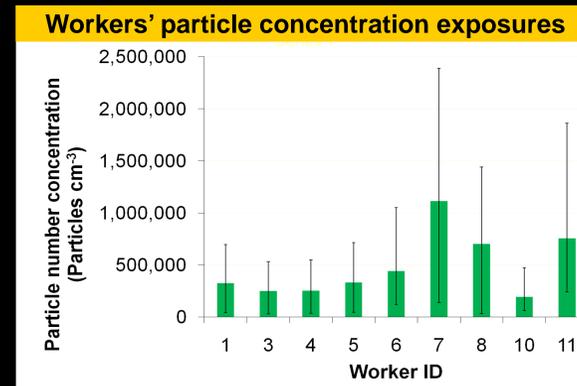
Objective

Assess workers' exposures to particles

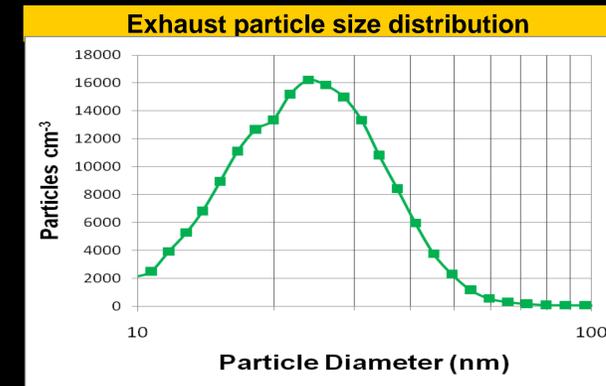
Methods

- Particle number concentration measured with a condensation particle counter outside the hood in the workers breathing zone and inside the local exhaust ventilation
- Particle size distribution measured in exhaust system with a scanning mobility particle sizer
- Aerosol mapping used to estimate particle number and respirable mass concentrations throughout the facility

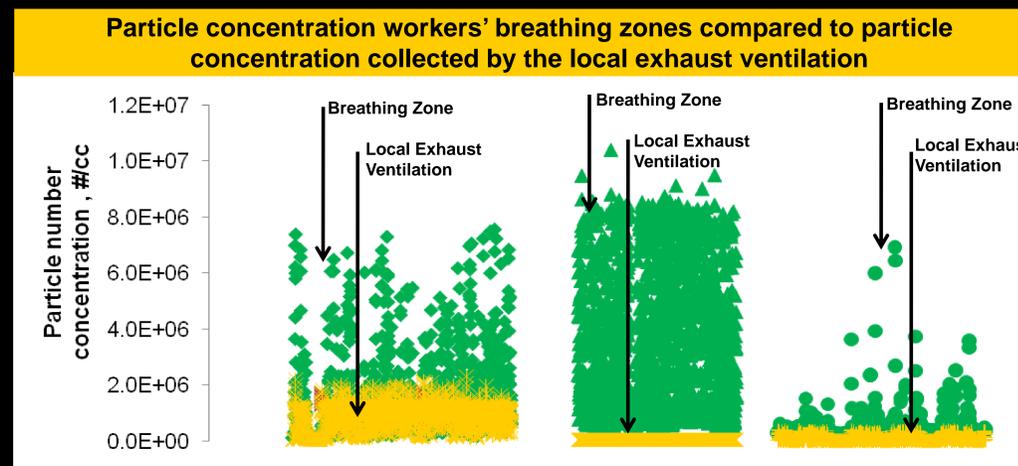
Results



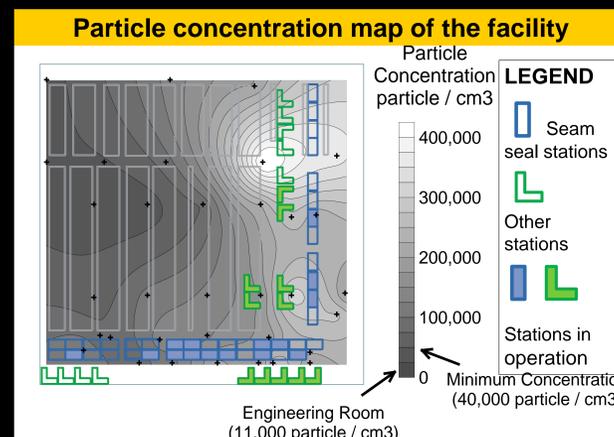
Particle exposure varied by worker. Error bars represent 1 geometric standard deviation.



Median particle diameter of 25 nm and geometric standard deviation of 2.



The local exhaust ventilation collects a fraction of the exhaust caused by the sealing of seams.



The particle number concentration throughout the plant was high compared to the engineering room (11,000 particles cm⁻³). The respirable mass concentration was low throughout the plant, therefore the workers were exposed to nanoparticles.

	Number Concentration, (Particles cm ⁻³)	Respirable Mass Concentration, (mg m ⁻³)
Range	39,000 – 450,000	0.001 – 0.007
Mean (SD)	164,000 (100,000)	0.002 (0.001)
Permissible Exposure Limit (OSHA)	none	5

Conclusions

- The workers' exposures to particles varied from worker to worker but all were high
- The workers were exposed to nanoparticles
- The local exhaust ventilation system is only partially effective in capturing fume from sealing seams
- The concentration of nanoparticles is high throughout the plant, exposing all workers to nanoparticles

Recommendations

There are no specific occupational exposure limits for PTFE fume.

Johnston et al. (2000) found that inhalation of PTFE fume consisting of large numbers of ultrafine particles can cause severe acute lung injury in rodents at concentrations of 50 µg m⁻³ (~750,000 particle cm⁻³) when inhaled for only 15 min.

We recommend target concentrations in the workers' breathing zones should be less than 100,000 particles cm⁻³.

References

Johnston, C. J., J. N. Finkelstein, P. Mercer, N. Corson, R. Gelein and G. Oberdorster (2000). "Pulmonary effects Induced by ultrafine PTFE particles." *UToxicology and Applied Pharmacology* 168(3): 208

Acknowledgements

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